BUILT TO ENDURE

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BUILT TO ENDURE

COMPARATIVE EXAMPLES OF NOTABLE ANCIENT AND MODERN CONSTRUCTION EMBODYING THE ELEMENT OF PERMANENCY.

BY PHILIP KOEHRING

ILLUSTRATED WITH ETCHINGS IN COLOR
BY WILLIAM MARK YOUNG

DEDICATED TO THE EXECUTIVES, ENGINEERS, CONTRACTORS AND CONSTRUCTORS WHO ARE DAILY BUILDING AMERICAN IDEALS OF WORTH AND PERMANENCY INTO ENDURING MONUMENTS OF BEAUTY AND UTILITY

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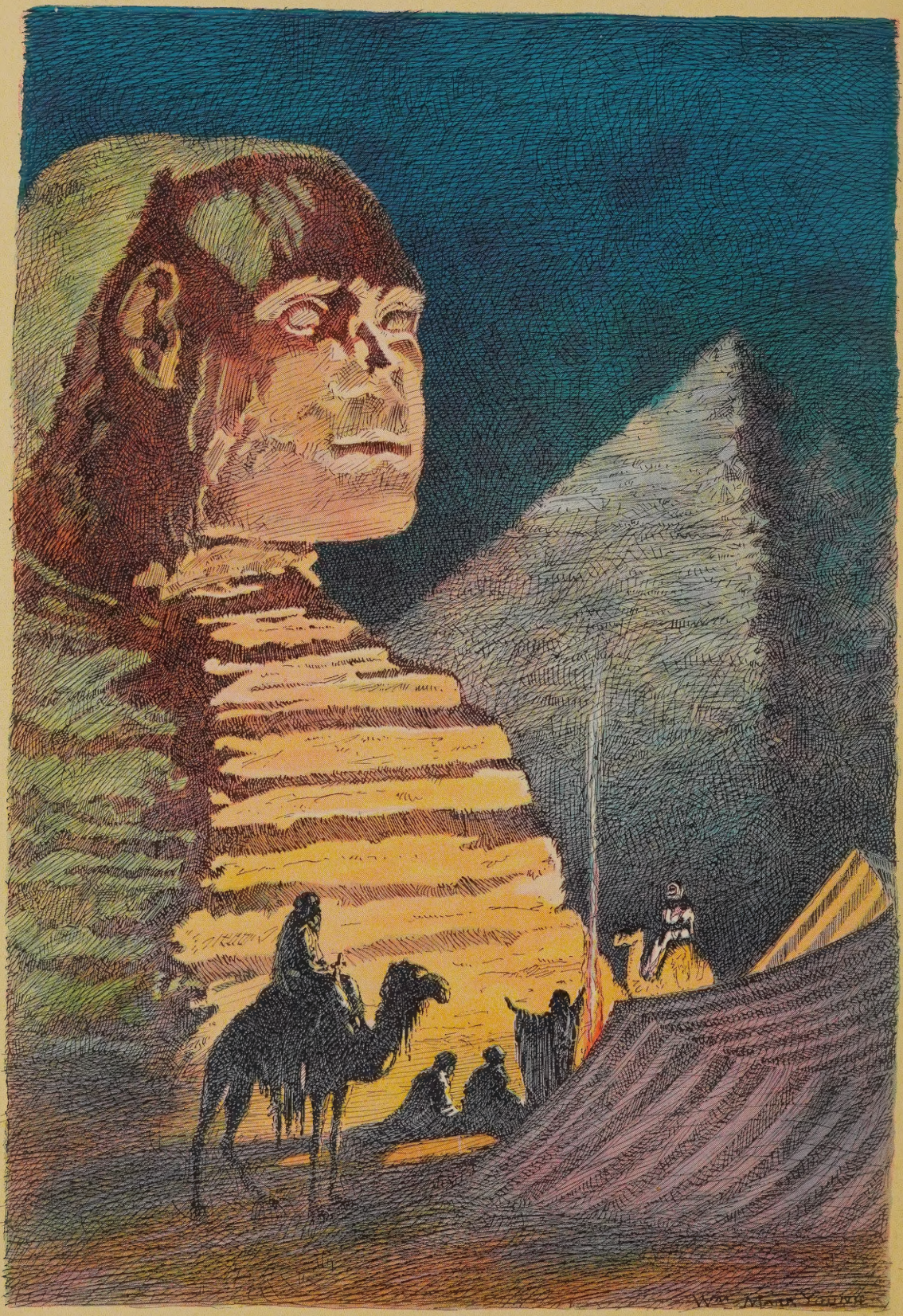


Foreword

IT must endure—this age long incentive to achievement reared the monuments of antiquity which mark the rise and fall of lost civilizations; cost toilsome lives of myriad workers; enslaving whole populations; perpetuated the memories of victories, generals and illustrious sovereigns; builded great public works and brought untold blessings to countless millions.

The restless germ of immortality which leavens human hearts and impels men to lives of rectitude finds concrete expression in structures of lasting usefulness and beauty.

Engineers of antiquity knew and utilized the secret of synthetic stone (concrete) in the building of their most permanent structures. Their methods, however, were crude and their work was accomplished only by the expenditure of great treasures of life and wealth.

Modern science and industry have added new discoveries to these age old secrets producing synthetic stone more enduring and permanent and a more pliant and ready servant of the architect and builder.

Marvelous economies in the making and handling of concrete have been invented in recent years, marking the epoch in which we live as "The Age of Concrete."

It is concrete which has made possible the great sewerage, sanitary and water systems of our modern cities; bridged our rivers; enabled us to erect gigantic warehouses and public buildings; dammed our streams and made available the vast water power of our nation; created vast reservoirs for the conservation of our oil resources; builded sea walls and break waters for the protection of our harbors and cities; crested our gapping valleys with great viaducts and reared monuments to our illustrious people in the far flung cities and plains of our nation.

The men who have made possible these achievements in concrete are entitled to the honor, credit and glory of enlarging, preserving and perpetuating the wonderful civilization which we are now enjoying.

The Acropolis at Athens

Heart of Greece and soul of beauty, the Acropolis of Athens towered 150 feet above the Attic plain and gave lofty prominence to a group of edifices the most famous and the most important artistically in the world's history.

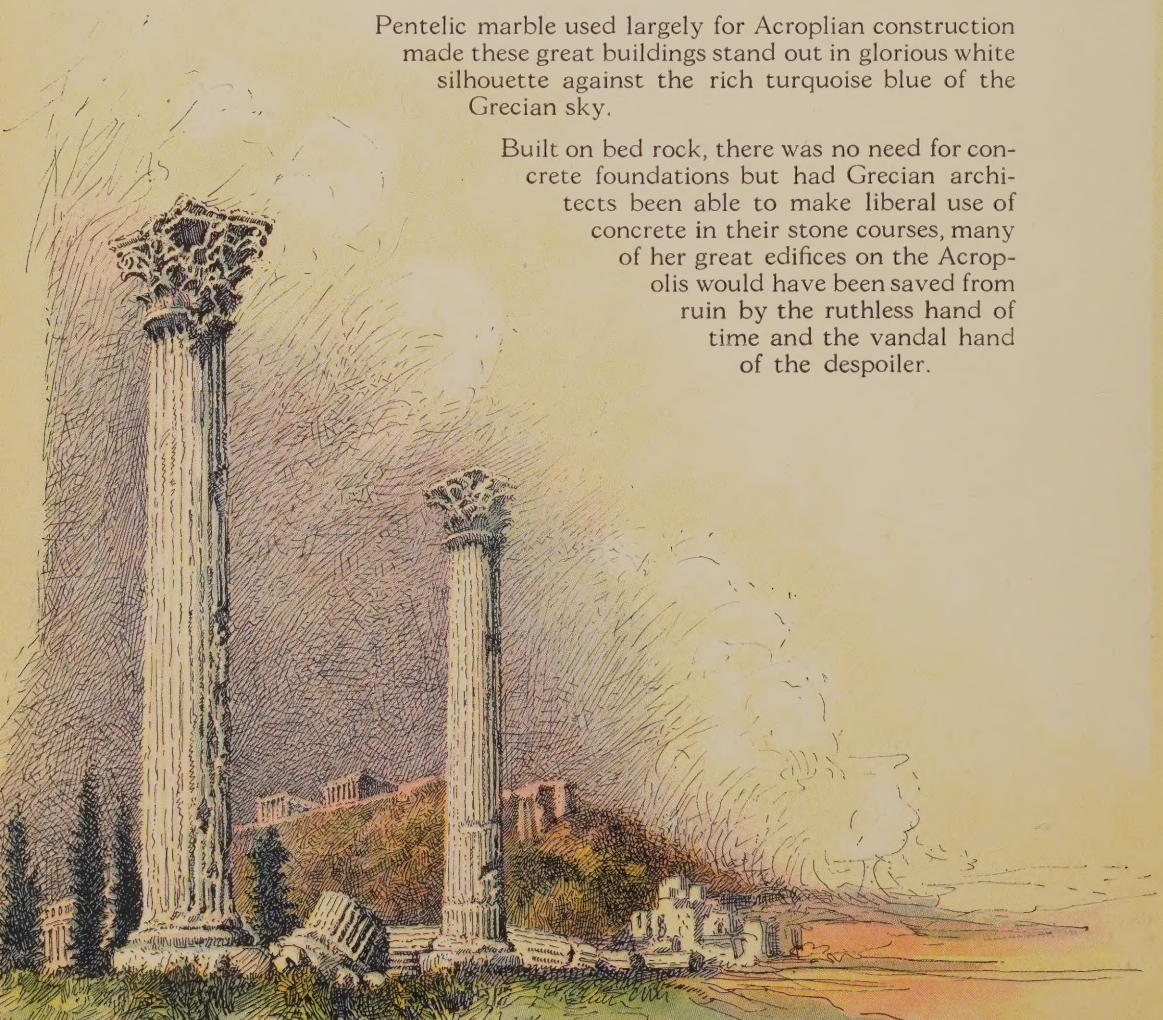
This rocky plateau 1,150 x 500 feet was surrounded by temples and theaters chief among them being the Temple of Aesculapius, the Theatre of Dionysus and the Odeon of Herod Atticus.

The summit was crowned by gems of architectural excellence which have given deathless glory to their designers—Phidias, Killikrates, Iktinus, Mnesikles and others who drew their inspiration from Themistocles, Cimon, and Pericles, the golden tongued of Athens. Here stood the Parthenon, the Temple of Nike, the Propylaea, the Pinacotheca, the Erectheum.

Marble was rejected as too common for the statue of Athene and ivory was used in its place; the gold with which it was surrounded weighed 40 talents ($46,000.00). The cost of the Propylaea is said to have been 3,000 talents ($3,450,000) at a time when Athens held 400,000 slaves.

Pentelic marble used largely for Acroplian construction made these great buildings stand out in glorious white silhouette against the rich turquoise blue of the Grecian sky.

Built on bed rock, there was no need for concrete foundations but had Grecian architects been able to make liberal use of concrete in their stone courses, many of her great edifices on the Acropolis would have been saved from ruin by the ruthless hand of time and the vandal hand of the despoiler.



The Bush Terminals

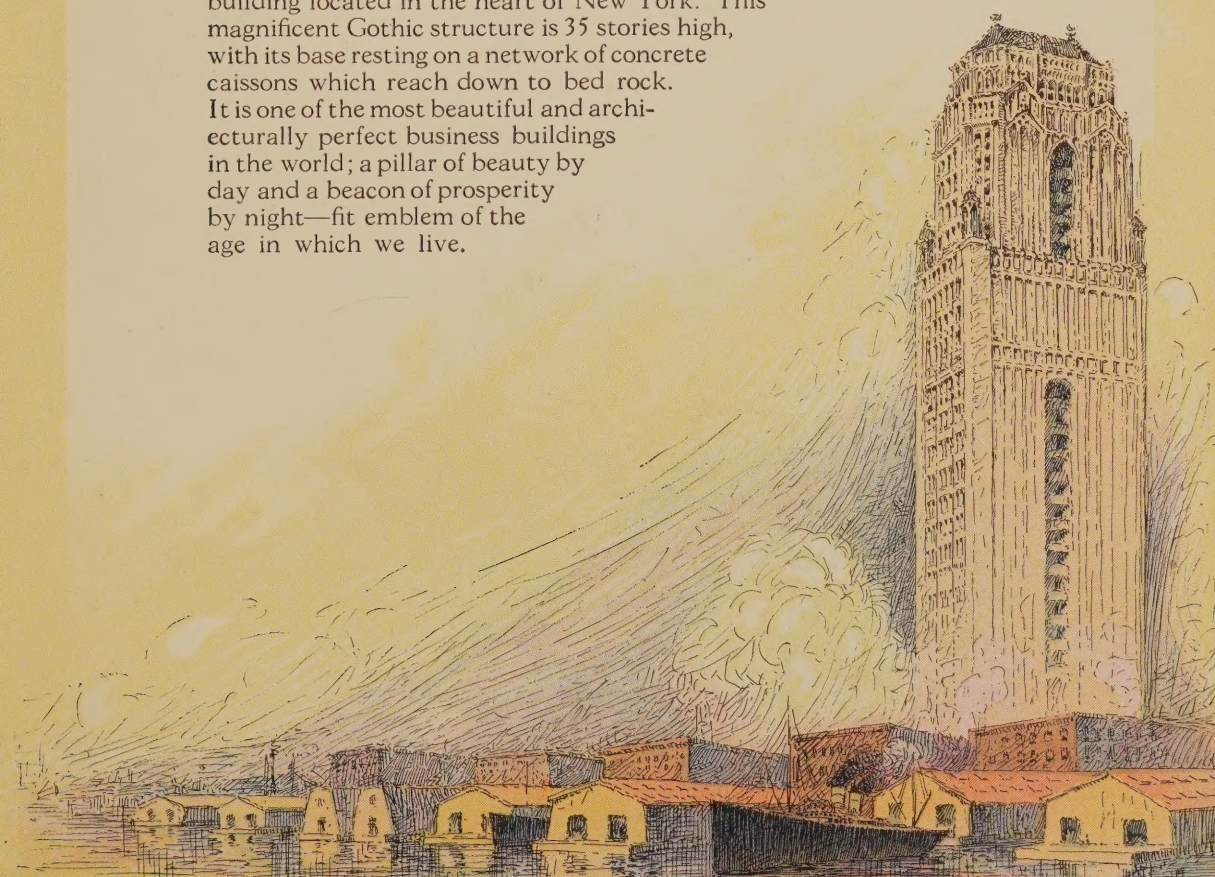
Commerce—or the exchange of commodities—is as old as civilization. Barter and trade break down the barriers of nations and breech the walls of racial prejudice. New York is America's principal harbor; the port of entry for the world's commerce and the gateway to the world's marts. The Bush Terminals are the greatest wharves of this great city.

The plant covers 200 acres. There are eight modern steel and concrete piers accommodating 27 steamship lines; 122 warehouses; 15 model loft buildings with more than 5,000,000 square feet of space used by 300 industrial concerns; a $1,000,000 eight story service building and cold storage plant with 1,500,000 cubic feet of cold storage space.

The Bush Terminal Railroad with nearly 25 miles of track and modern equipment is a salt water terminal for the ten main trunk lines reaching the port of New York.

The evolution of an idea started more than a quarter of a century ago, the Bush Terminals are an example of an idea wrought in steel and stone (concrete). Brooklyn warehouses containing 26,000,000 cubic feet of storage space are operated in connection with the plant.

Executive management of all the terminal properties is conducted from the sales and administration building located in the heart of New York. This magnificent Gothic structure is 35 stories high, with its base resting on a network of concrete caissons which reach down to bed rock. It is one of the most beautiful and architecturally perfect business buildings in the world; a pillar of beauty by day and a beacon of prosperity by night—fit emblem of the age in which we live.



Colosseum at Rome

Roman palaces, amphitheaters and monuments loom out of history in all the beauty of their architecture and perfection of engineering because the Roman contractors made liberal use of concrete.

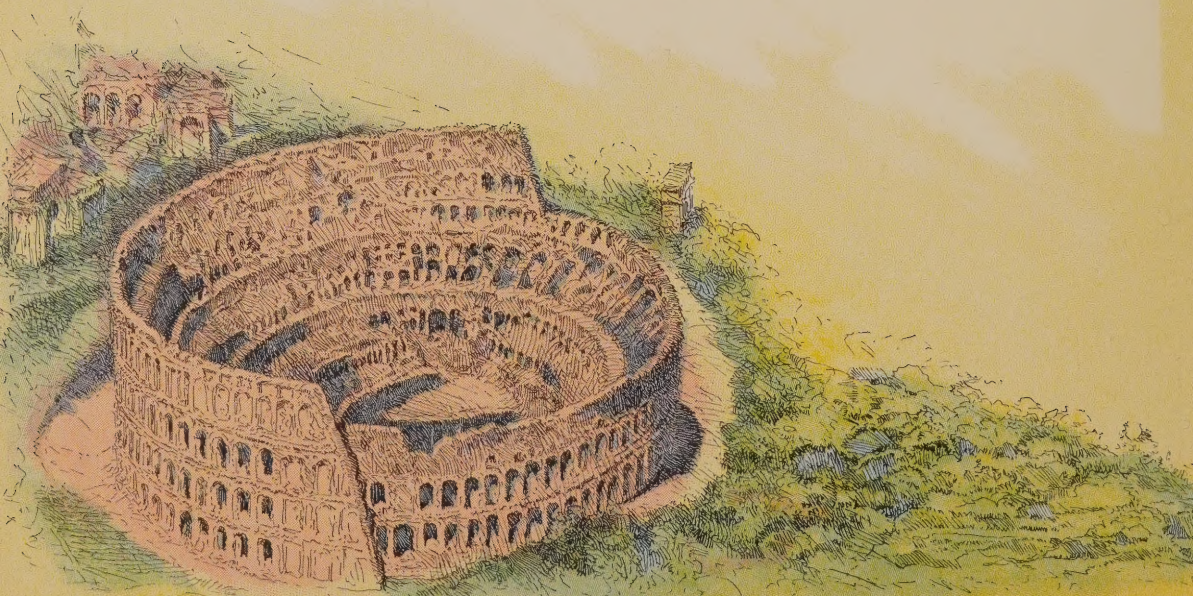
The tireless hand of time stripping the ornate bricks, tile and marble from the ancient walls lays bare the enduring concrete upon which these early engineers relied for strength and permanence.

The Colosseum takes its name from the Colossus of Nero which towered 120 feet above the colonnades of the Golden House of Nero on whose site the Colosseum was erected by Vespasian and Titus. It was opened in A. D. 80 with a magnificent celebratory pageant in which 5,000 wild beasts and numerous gladiators were slain.

It seated 87,000 people and was 500 feet long, 300 feet wide and 120 feet high; 12,000 Jewish slaves, brought captive from Jerusalem, labored for five years on the lower of the six great tiers, during which time ten million Roman scoudi were spent; the architect is unknown.

The upper stories originally built of wood, ornately gilded, were destroyed by lightning and fire in the reign of Emporor Macrinus and were rebuilt in stone and concrete by Gordianus III; a task that took "twenty years in a great building era" and cost more than ten million dollars.

Countless lives and over one hundred million dollars were spent on the building, its ornamentation, equipment and appurtenances. Despite the spoliation of medieval rulers who used it as a quarry and built from it many palaces, the Colosseum endures today, a glorious relic "of the days that were Rome" because its massive foundation, sustaining walls, arches and passageways were built of concrete—fluid stone of the ages.



Stadium of the New York "Yankees"

Sport today, as in ages past, supplies the incentive for the erection of our largest Stadium—the new home of the New York Americans ("Yankees") now under construction. Here, as in the Flavian Colosseum, reliance is placed upon the strength and endurance of concrete.

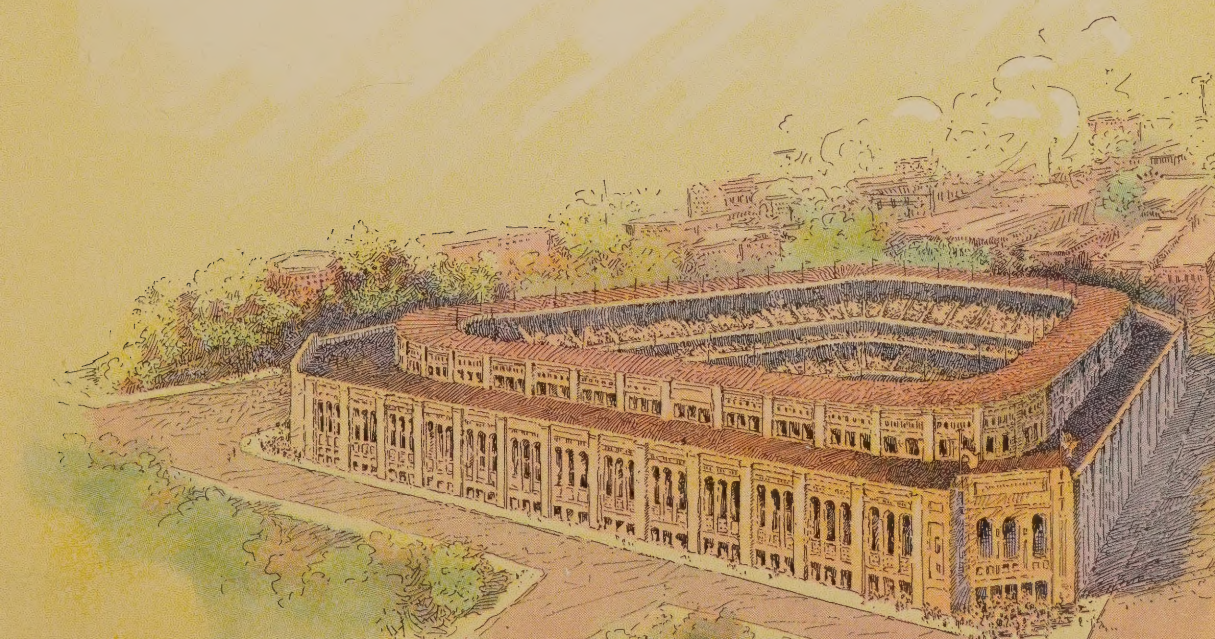
This Stadium will seat 80,000 people on three mammoth decks. The first deck is being built entirely of reinforced concrete upon reinforced concrete columns running to concrete foundation. The mezzanine and upper decks are of reinforced concrete slabs laid upon cantilever superstructures.

Reinforced concrete ramps or inclines provide for quick continuous flow of spectators at gentle grades. Externally the Stadium is architecturally pleasing; within it is a marvel of designed utility—so much for modern ingenuity!

Instead of draining the resources of the nation and becoming a topic of conversation over the civilized world, it will cost but a fraction of its historic prototype either in life, time or money and its building will proceed practically unnoticed—so much for modern progress!

The architects to whom was given the task of designing this great amphitheater had to give consideration to three factors—speed of construction, cost and permanency—the answer to all these was—"Concrete."

Concrete—plastic stone of eternity—since the days of Roman contractors has been the willing servant of architects and engineers in the erection of theaters, palaces and temples.



The Roman Viaduct at Nimes

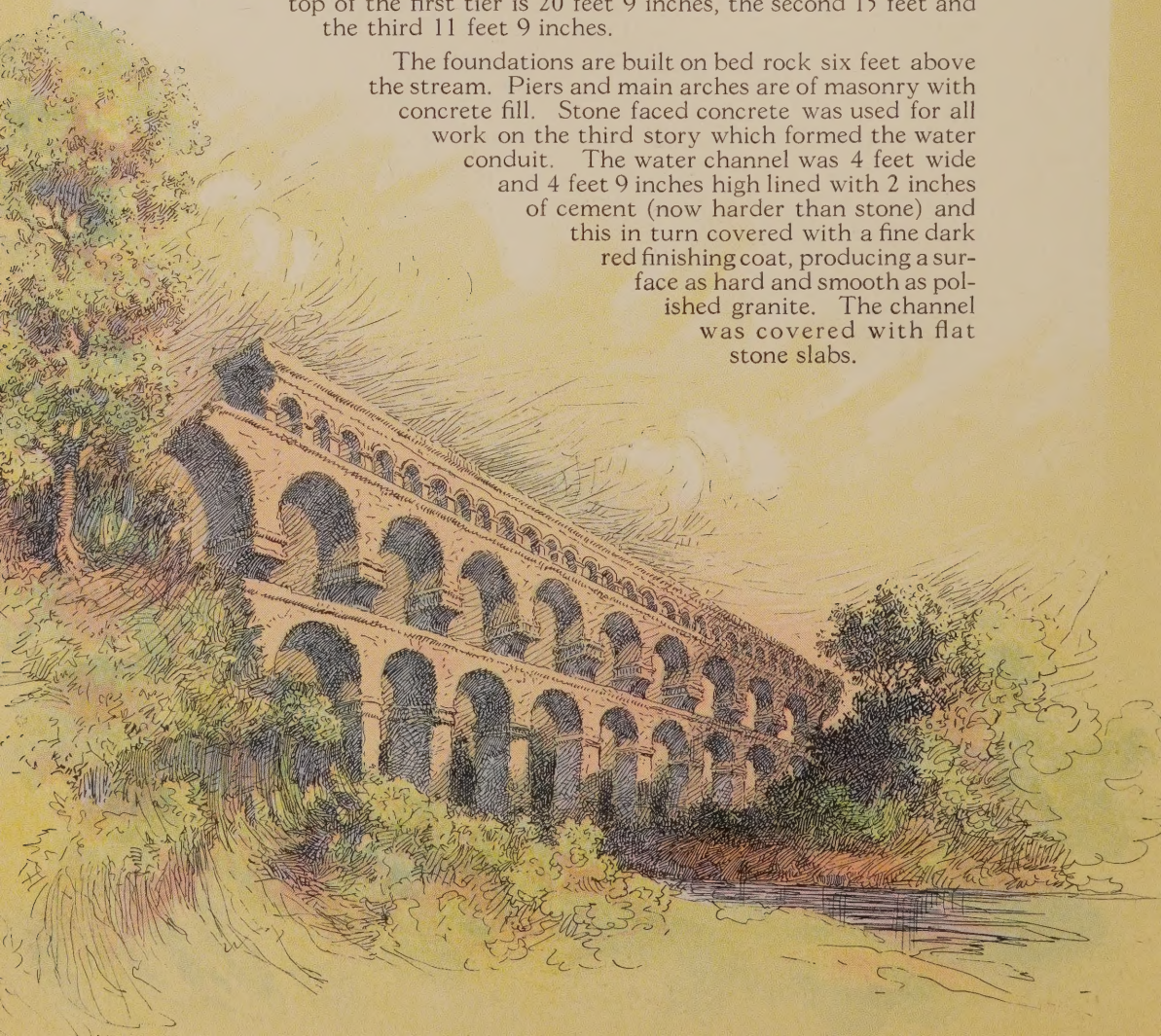
The stately stone and cement arches that tower out of the dusk on the deserted plains of the Campagna, are eloquent of the wonderful water system that made Rome one of the marvelously sanitary cities of all time. Highways and sanitation were the civilizing influences the Caesars used to bind conquered territory to Rome.

Grandest and most beautiful of all Roman works in foreign lands is the still extant viaduct known as the Pont du Gard at Nimes, France; built by Agrippa, Governor of Nimes, under the direction of Emperor Augustus Caesar at the dawn of the Christian era, it is still in excellent condition.

The viaduct was designed to bridge the valley of the Gardon and carried on its sturdy arches the commerce of that busy district as well as the water essential to its sustenance and sanitation.

It has a height of 161 feet from the bed of the river, a length at the first story of 562 feet and at the top of the second story of 885 feet. The capital arch through which runs the River Gardon, spans over 80 feet, while the other large arches are from 51 to 63 feet span; the small crown arches are 15 feet 9 inches. The width at the top of the first tier is 20 feet 9 inches, the second 15 feet and the third 11 feet 9 inches.

The foundations are built on bed rock six feet above the stream. Piers and main arches are of masonry with concrete fill. Stone faced concrete was used for all work on the third story which formed the water conduit. The water channel was 4 feet wide and 4 feet 9 inches high lined with 2 inches of cement (now harder than stone) and this in turn covered with a fine dark red finishing coat, producing a surface as hard and smooth as polished granite. The channel was covered with flat stone slabs.



The Tunkhannock Viaduct

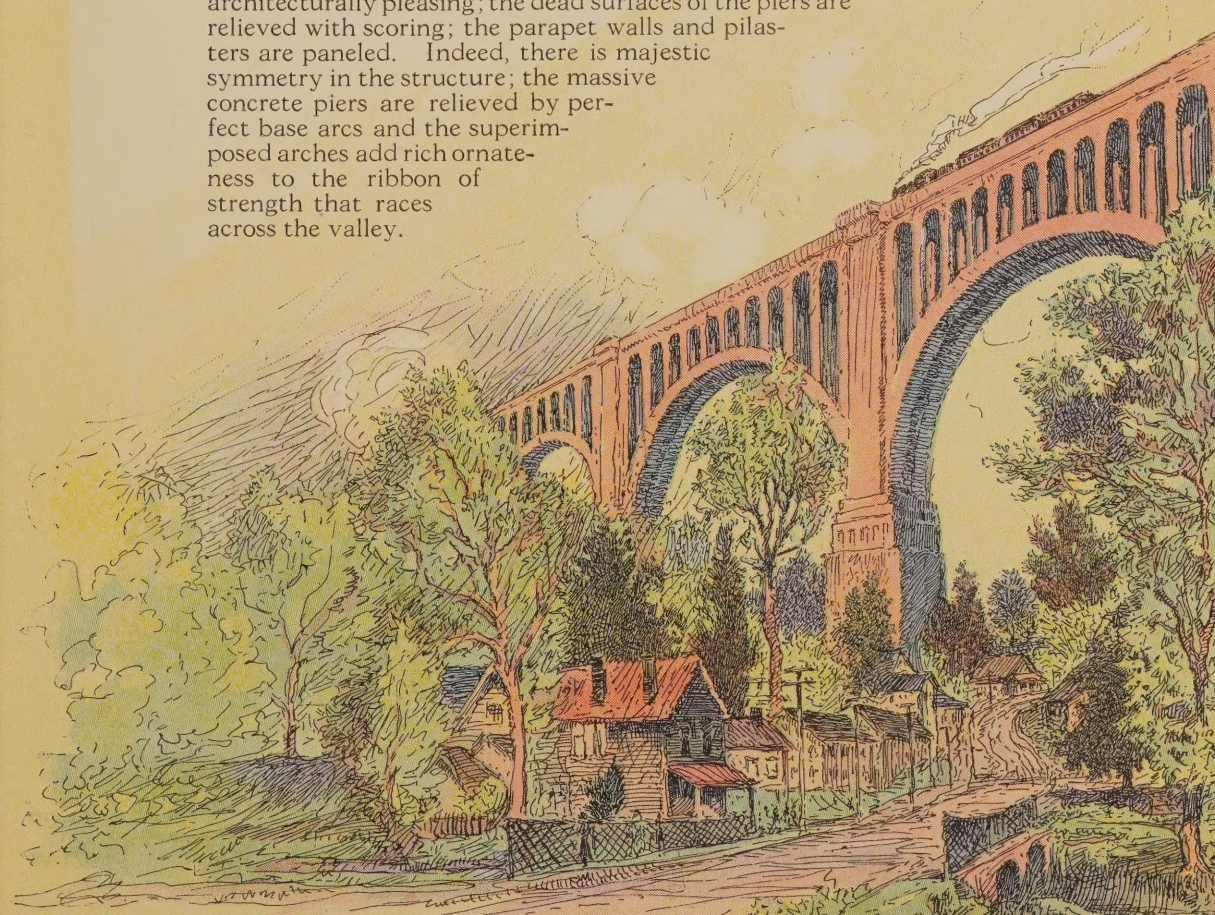
The honor of building the world's largest railroad viaduct belongs to the Delaware, Lackawanna & Western Railroad Company for its Tunkhannock Creek cut-off near Nicholson, Pa.

Work was started in August, 1912 and completed in 1915. It is of reinforced concrete, 2,375 feet long, 240 feet high above the creek and 34 feet wide; it carries a double track. Foundations run down to bed rock which was reached at from 10 to 100 feet below the surface of the ground.

Ten 180-feet and two 100-feet full centered arches are used, the latter being abutment arches. Rising majestically from the foundation piers the main arches are divided into two parallel ribs each, 14 feet wide and 6 feet apart. Each main arch carries eleven 13-ft. 6 in. transverse spandrel arches. Above these lesser arches are two reinforced concrete parapet walls, each 3 feet thick and 4 feet above the top of the rail. The approaches and viaduct required 167,000 cubic yards of concrete and 2,300,000 pounds of reinforcing steel.

The architects of Greece and Rome sensed the inspiring truth—that beauty is a necessary part of life, and reflected it in their designs which endure to this day—in fact utility has departed from their work and only art lives. Modern engineers and constructors exemplify similar ideals in this viaduct.

An earnest effort has been made to produce a structure architecturally pleasing; the dead surfaces of the piers are relieved with scoring; the parapet walls and pilasters are paneled. Indeed, there is majestic symmetry in the structure; the massive concrete piers are relieved by perfect base arcs and the superimposed arches add rich ornateness to the ribbon of strength that races across the valley.



The Bridge of the Seine

An engineer delving into the beauties and ruins of ancient Persia, tells us that we are indebted to the bridge builders of that once great kingdom for the Gothic arch. Roman bridges, aqueducts and arched edifices preserved for Europe and the world the engineering principles and architectural triumphs of Rome's golden minds, triumphs greater than those won by her sword.

Paris, queen of beauty, was born upon an island in the Seine called "L'Isle de la Cite." Upon it stand the great, grey towers of Notre Dame, and the slender gilded spires of the Sainte Chapelle rise high above the modern buildings crowded between the quays.

La Pont Neuf, "The New Bridge," oldest of all Paris bridges—magnificent monument of medieval France—links the old city to the Latin Quarter on the South and to modern Paris on the Northern bank.

Construction was started under Henry III in 1578 from plans by Androuet du Cerceau. War delayed work. Henry IV started construction again in 1602 and completed it in 1607. Built in two sections it spans the Seine across "The Island of the Ship." One section has 7 arches from 46 feet to 62 feet 4 inches span, while the other section has only 5 arches from 31 feet 3 inches to 48 feet; all spans are semi-circular.

The entire width of the bridge is 72 feet, part of it overhanging the arches, being supported by ornamental brackets. Built of massive masonry laid and backed by concrete, it pays tribute to the skill of its designer and the craftsmanship of its builders. The great bulk of its proportions rob it of grace—a beauty which modern reinforced concrete could have built into it.

Hell's Gate Bridge

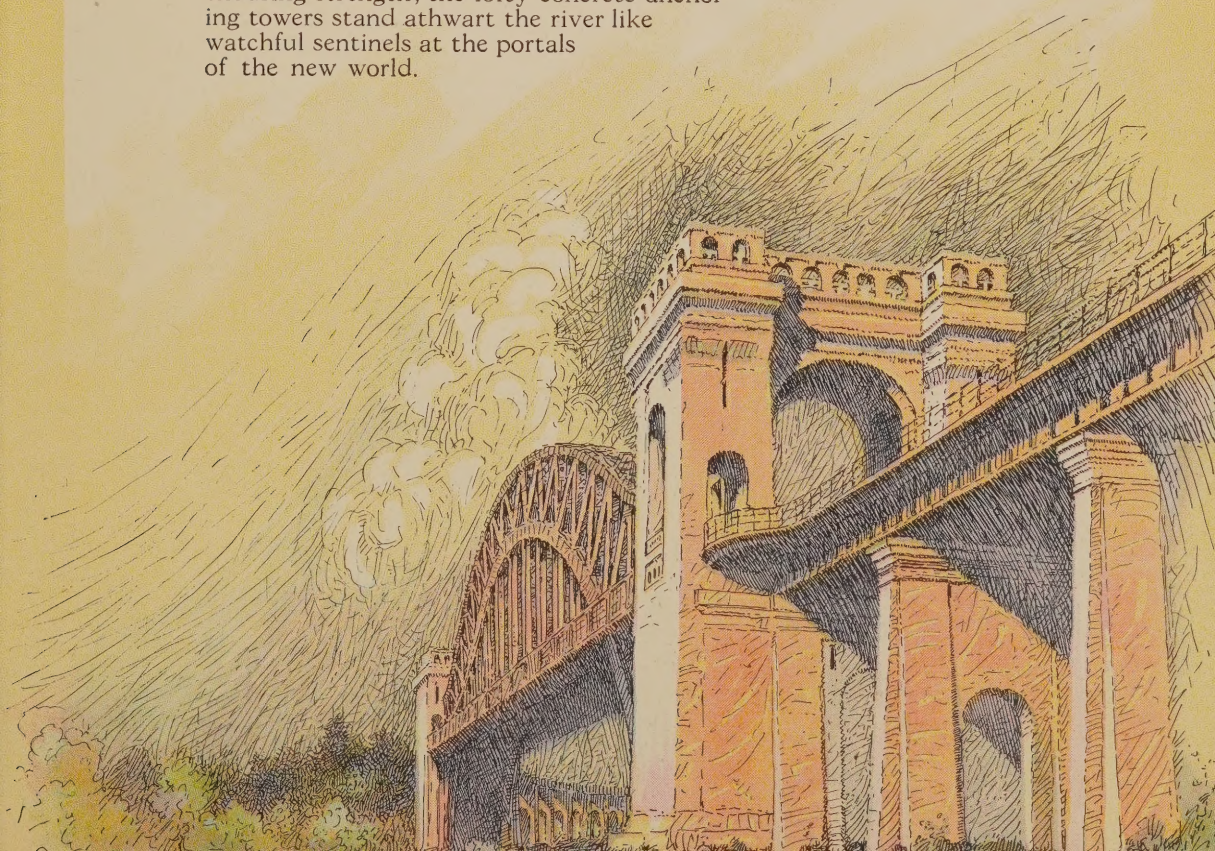
Improvement of transportation on road and rail has furnished the incentive for many of America's engineering triumphs. Hell's Gate Bridge, spanning the East River at New York, carries the largest arch-span in the world, 977 feet long; it is of the two-hinged, braced-rib type. A total weight of 20,000 tons of steel, capable of sustaining a dead load of 50,700 pounds per lineal foot; is carried on two giant concrete towers.

The Ward's Island Tower is built on 21 pneumatic concrete caissons (15 cylindrical 18 feet diameter, and 6 rectangular, 30 x 41 feet keyed together) running down to bed rock 109 feet below water. These caissons contain 28,000 cubic yards of concrete; the tower above the foundation contains 38,000 cubic yards of concrete and granite facing.

The Long Island Tower foundations reach bed rock at 15 feet below the ground and required but 5,000 cubic yards of concrete; the tower above the foundation required 37,300 cubic yards of concrete and granite facing. Both towers are 250 feet above mean low water.

The bridge clearance is 140 feet above low water. The bridge and its approaches are over 18,000 feet in length; the viaduct consists of a series of beautiful concrete arches; the whole work required about 90,000 tons of steel and over 460,000 cubic yards of concrete.

Gustave Lindenthal, the noted bridge engineer who designed this great structure, did not overlook its aesthetic qualities and the graceful arches that carry the broad causeway out to the giant arched span embody stately beauty as well as enduring strength; the lofty concrete anchoring towers stand athwart the river like watchful sentinels at the portals of the new world.



Pyramid of Cheops

The pyramid of Cheops (Kheops) is the grandest monument of all time. It brings to us through the dim light of lost centuries the name and fame of its builder.

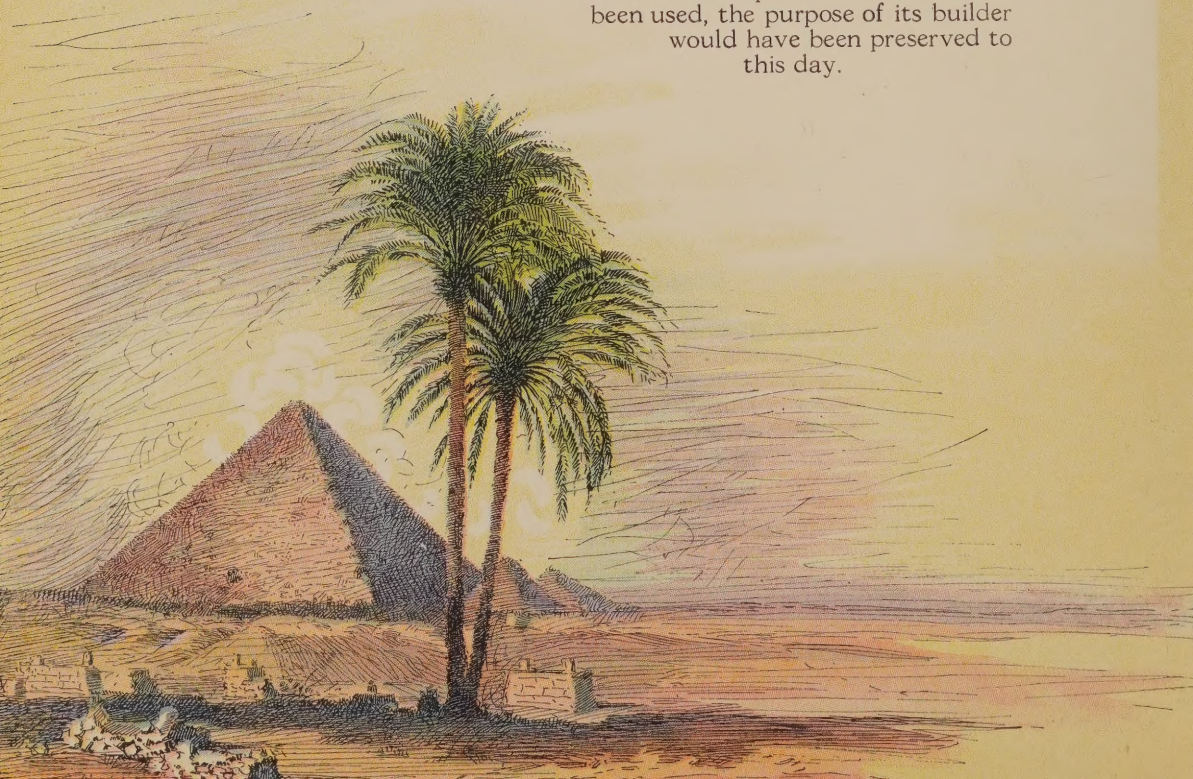
Its base was a square of 764 feet; its height was 476 feet; geometrically its height was the radius of a circle equal to the circuit of its base. It was exactly oriented on the points of the compass. Into its construction entered 3,430,115 cubic yards of masonry whose combined weight reached the stupendous tonnage of 7,872,114.

One hundred thousand men worked ten years to build the causeway along which the blocks were dragged by human hands from the banks of the Nile. Another hundred thousand men toiled for twenty years in the actual construction of this monument. Four thousand master masons superintended the actual hewing and squaring of the blocks.

Lacking knowledge of synthetic stone (concrete), and believing that native stone was the most enduring, Cheops built the mammoth pile of lime stone and finished its surface with polished blocks of colored granite so subtly joined that it appeared to be a single slab from top to bottom. The flatness and squareness of the joints are comparable to the exactness with which a modern optician works.

The stone entering into the construction of this pyramid, represents material which under modern engineering and construction practice would be but the output of 191 days of our largest cement factory and crushed stone plant. It is estimated that the pyramids could be built today with one one-hundredth the number of hours of actual labor involved in its original construction.

The secrets which were locked within its massive blocks resisted the vandal hands of the Arabs for centuries but were at last despoiled. Had concrete been used, the purpose of its builder would have been preserved to this day.



Black Hawk Monument

Towering 250 feet above Rock River near Oregon, Illinois, stands a gigantic statue of Black Hawk—Lorado Taft's tribute to the American Indian and the largest concrete monument on our continent if not in the world.

Its commanding position and majestic proportions give to the statue a nobility of poise harmonious with the contemplative courage depicted on the features of the Indian warrior.

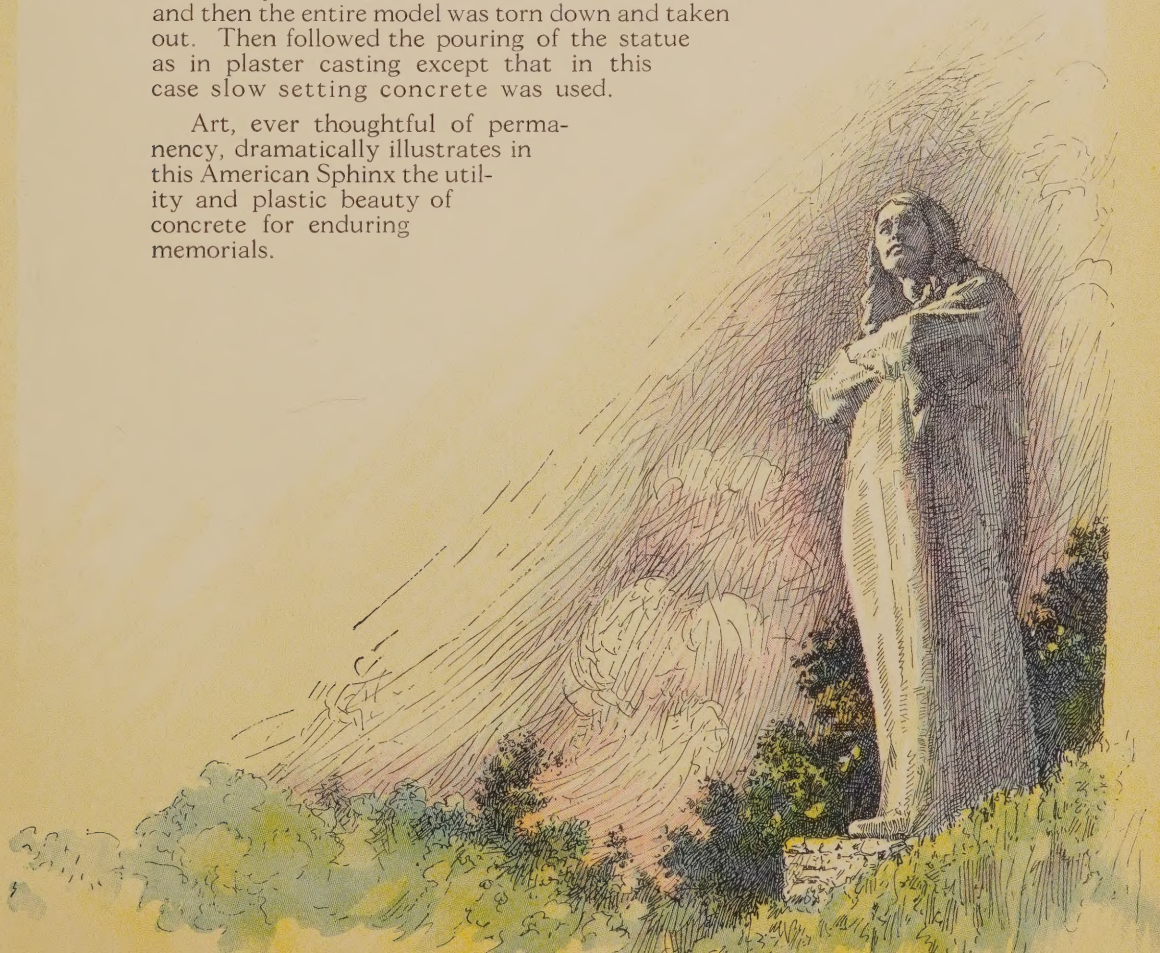
The statue stands on an eighteen foot concrete pedestal anchored to the solid rock of the river cliff and rises to a height of 42 feet. It contains about two tons of twisted steel reinforcing rods and approximately 238 cubic yards of concrete, 20 tons of which are ¼ inch to dust pink granite screenings used for the surface, giving it the appearance of a granite statue.

Maximum wind pressure acting on statue—28,980 lbs. Overturning effort of wind pressure 678,785 foot lbs. Total resistance to wind pressure acting through center of gravity on 18 ft. base—4,830,930 lbs.

Four hundred and twelve barrels of Portland cement were used. The total weight of the statue is nearly 300 tons.

Mr. Taft made his first working model six feet in height; this was enlarged seven times by an ingenious machine devised by the contractor. About it was built a mold and then the entire model was torn down and taken out. Then followed the pouring of the statue as in plaster casting except that in this case slow setting concrete was used.

Art, ever thoughtful of permanency, dramatically illustrates in this American Sphinx the utility and plastic beauty of concrete for enduring memorials.



The Appian Way

"All roads lead to Rome." Her highways made neighboring nations tributary to her greatness. Now, as then, civilization keeps step with transportation.

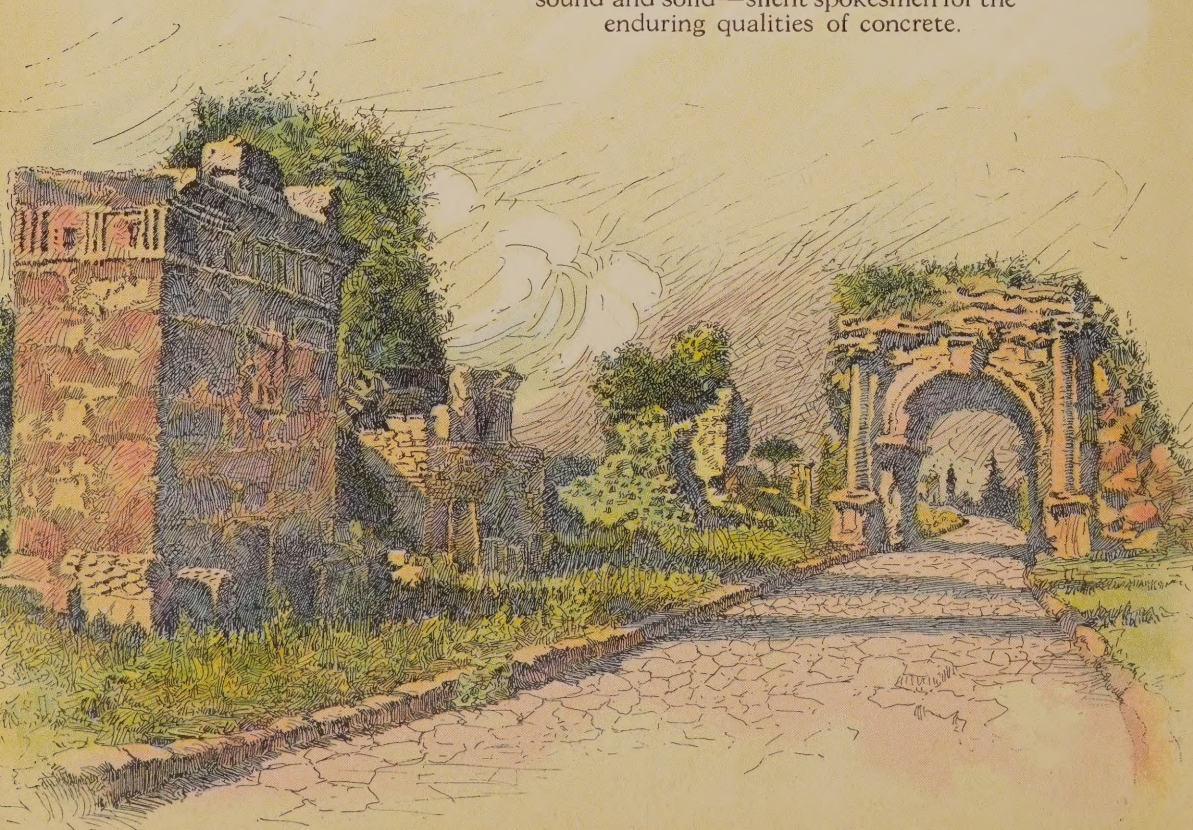
The roads of Rome rank with her aqueducts as masterful examples of engineering principle and practice. The men of valor who made possible Roman power were also men of vision—only as hard highways radiated from the Imperial City could her legions maintain order and peace throughout her domain.

The Appian Way was the first as well as the longest of the Roman roads. It ran from Rome to Capua and later to Brundusium (Brindisi) 360 miles. It was built by Censor Appius Claudius Caecus in 313 B. C. coincident with the construction of the Aqua Appian or first Roman aqueduct. It was paved with blocks of lava set in a crowned foundation of concrete. Massive concrete and stone arches carried it south through the valley of Arrica; tunnels cut through solid rock by Augustus brought it from Naples to Puteoli.

Julius Caesar was its Curator in 65 B. C. and on it was erected the first known monument to a road contractor—one of its actual builders—bearing this inscription "MANCIPE—VIAE—APPIAE."

This great highway so intimately identified with Roman progress and culture issued from the Servian "Porta Capena" and the Aurelian "Porta Appia" (modern St. Sebastiano).

Rome in her palmiest days possessed over 55,000 miles of improved highways. The ceaseless tread of thousands of years has worn away the surface but so wisely was it built that even now those ancient road foundations are sound and solid—silent spokesmen for the enduring qualities of concrete.



The Lincoln Highway

Highways are the arteries of a nation's life blood. Through them flow steady streams of traffic carrying commerce and trade from production and distributing centers. The speed, safety and economy with which a nation is able to gather and distribute its products is an index of its progress and prosperity.

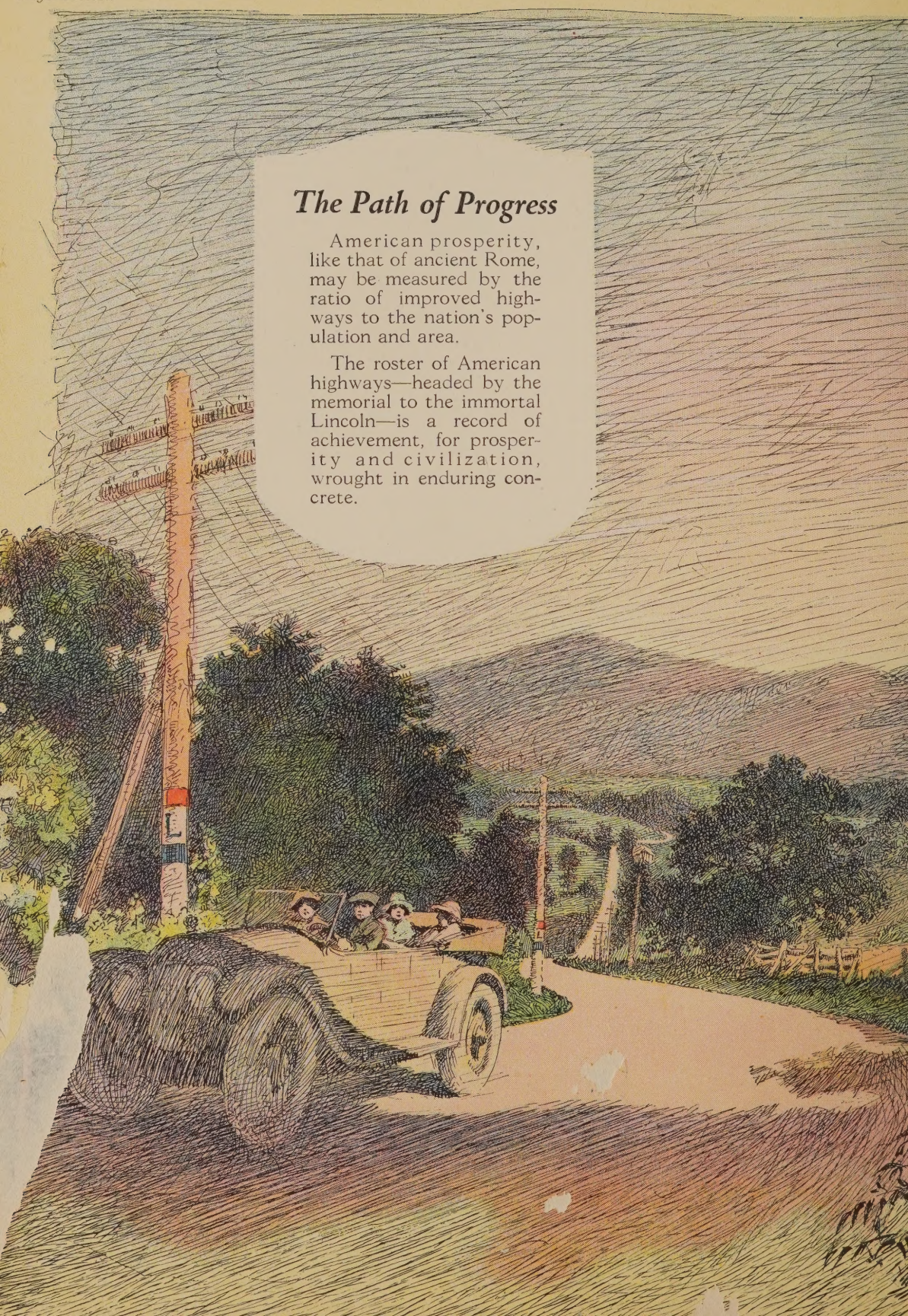
The white race holds dominion over the world—it has always been the builder of roads. In peace or war the highways of a nation are equally essential.

America has 2,500,000 miles of highways and only 365,000 miles of railways. The most famous of all American highways is "The Lincoln Highway" the "Main Street" of the continent, reaching from New York to San Francisco, a distance of 3,305 miles.

Started in 1913, the Lincoln Highway has not only wrought an ideal in concrete from Atlantic to Pacific, but has germinated the highway idea in all parts of the land so that communities everywhere are giving substantial encouragement to concrete road construction.

This period of concrete road building has been coincident with the development and wide use of automobiles and motor trucks. These vehicles now constitute a system of transportation as important to our prosperity and progress as our railroad and steamship systems. A tremendous burden of road maintenance is lifted when concrete highways are built.

Concrete, the magic medium of modern empire builders, is shortening the vast distances of America and making distant localities neighbors and building enduring prosperity into our industrial life.



The Path of Progress

American prosperity, like that of ancient Rome, may be measured by the ratio of improved highways to the nation's population and area.

The roster of American highways—headed by the memorial to the immortal Lincoln—is a record of achievement, for prosperity and civilization, wrought in enduring concrete.

Rome's Water System

The engineers of ancient Rome excelled in the knowledge of the methods and means of obtaining, transporting and distributing an adequate water supply for all the needs of her citizens.

Prior to 312 B. C. Rome was dependent upon the River Tiber for her water supply; in that year Censor Appius Claudius constructed the first aqueduct.

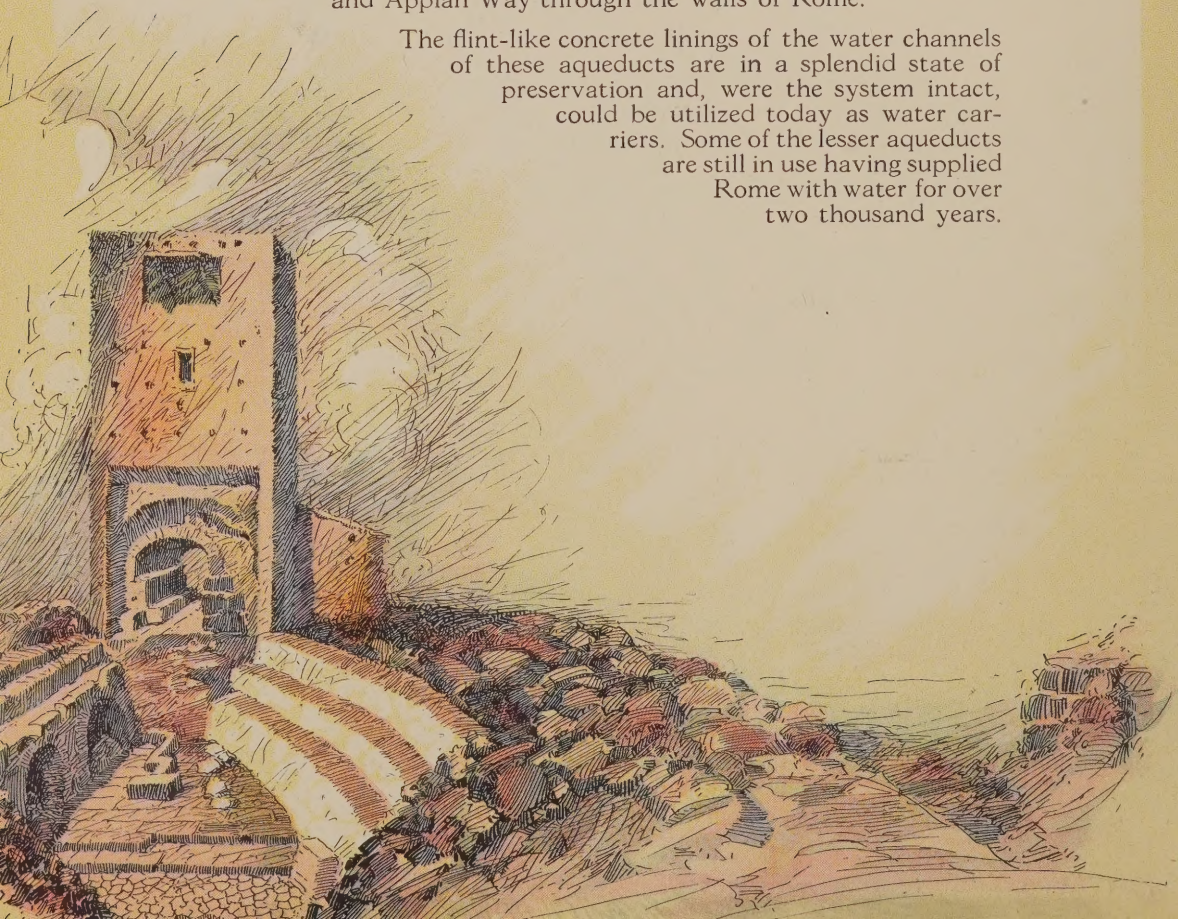
Nine aqueducts brought water into Rome at the end of the first century, some of them such as Anio Novus, were as much as 62 miles in length; the earlier aqueducts were largely subterranean; the latter ones crossed the Campagna on series of imposing arches massively built of concrete and stone—the water channels invariably of concrete.

The costs were staggering even in those days of cheap labor and abundant slaves. The Aqua Claudia cost $2,750,000; Aqua Marchia $9,000,000; the total cost of the Roman aqueducts exceeded $100,000,000 in the days when gold had a purchasing power much greater than it has today.

The elaborate Roman water system embraced aqueducts, reservoirs, filters and distributing mains of great ingenuity and marvelous complexity.

How her engineers combined highway and water systems is well illustrated where the Porta Capena brings the Appian Viaduct and Appian Way through the walls of Rome.

The flint-like concrete linings of the water channels of these aqueducts are in a splendid state of preservation and, were the system intact, could be utilized today as water carriers. Some of the lesser aqueducts are still in use having supplied Rome with water for over two thousand years.



The Roosevelt Dam

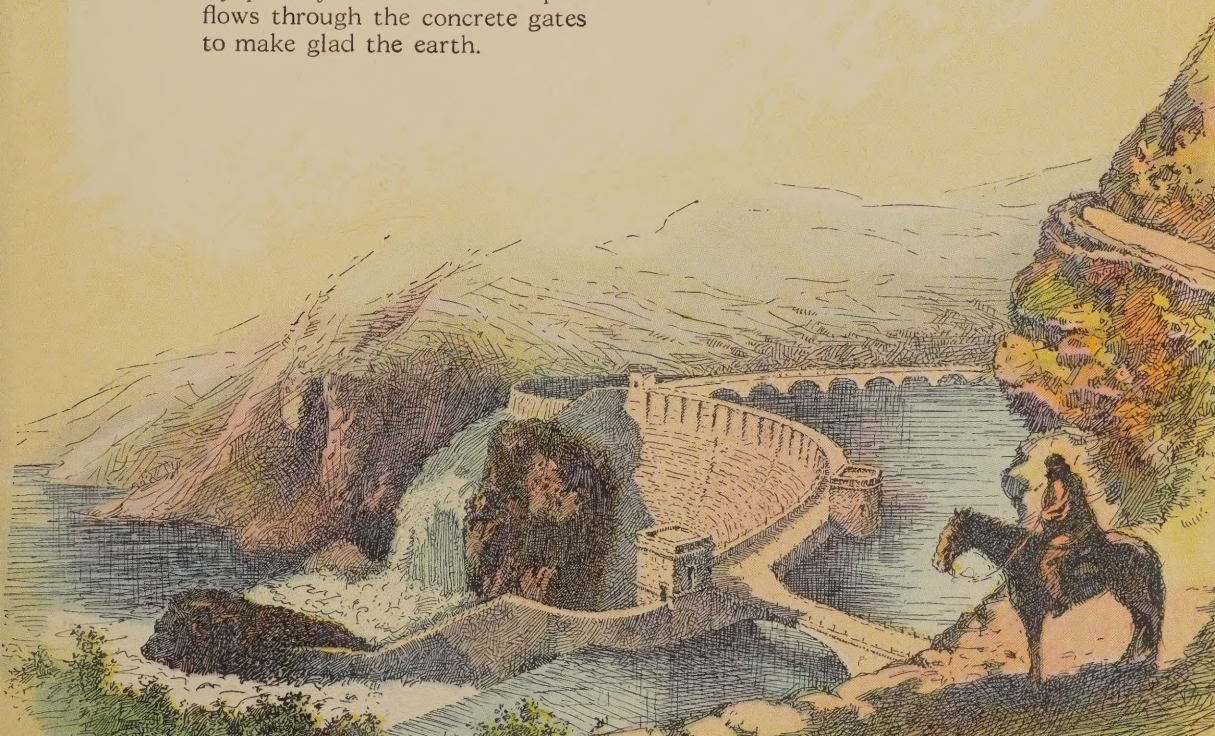
The Roosevelt Dam is one of the most impressive of modern irrigation projects; almost one of the wonders of the modern world. Located out of Phoenix, Arizona, 60 miles from the nearest railroad, the contractors had first to construct a broad concrete highway to render it accessible for material and supplies.

Spanning a natural canyon of the Salt River on bed rock, the dam raises its majestic curved crest of solid concrete rubble masonry 280 feet, with a length on its parapet of 1,125 feet. Its cubical content is 326,000 yards. The first stone was laid on September 20, 1896 and it was formally dedicated March 18, 1911.

The reservoir created by the dam covers 16,800 acres or over 26 square miles; the waters impounded equal 1,365,000 acre-feet. A vast desert realm of 200,000 acres or 312 square miles was brought under irrigation by the Roosevelt Reservoir and while the cost was $11,500,000 the crops for a single year have totaled a gross volume of $18,000,000.

The engineering skill developed in the creation of Rome's water supply was the marvel of the ancient world but it is dwarfed by contemplation of the massive concrete dams, conduits and spillways of our western reclamation projects. The difference is not so much in materials as in methods—modern ingenuity has robbed work of its laboriousness; the clanking of slave chains is replaced by the rattle of machinery; the crack of the whip by the toot of the horn.

Where once lay an arid Arizona desert now blossoms an inland Empire of fruitfulness—waste has been swallowed up by plenty and conserved power flows through the concrete gates to make glad the earth.



Boulevard Link—Chicago

One of the most beautiful automobile drives to be had in any city is the Lake Shore Drive along Lake Michigan in Chicago. Connecting this section with the great commercial "Loop" is Michigan Avenue, which is the main thoroughfare for vehicular traffic north and south.

Although the river is responsible to a large extent for Chicago's commercial growth, it has created a difficult highway traffic problem due to the conjestion at the bridges. Because of this, it was decided a few years ago to construct a double deck structure connecting Michigan Avenue on both sides of the river.

Work on the bridge, known as the Boulevard Link, was started in April, 1918, and practically completed in May, 1920. The double level improvement extends for a length of about one mile; it is 66 to 80 feet wide, with 15 foot sidewalks. Heavy trucking crosses the river on the lower level, while boulevard traffic uses the upper deck. Navigation is speeded up by the use of a trunnion bascule bridge, with a freeway between abutments of 220 feet.

Five Koehring Mixers placed 30,000 cubic yards of concrete in this construction, including the retaining wall along Michigan Avenue, the counterweights for the rolling bridge, and floor paving of the viaduct.

About 500 workmen were employed and the cost to the city of the improvement including property indemnity was $16,000,000.

Ocean Parkway—Brooklyn

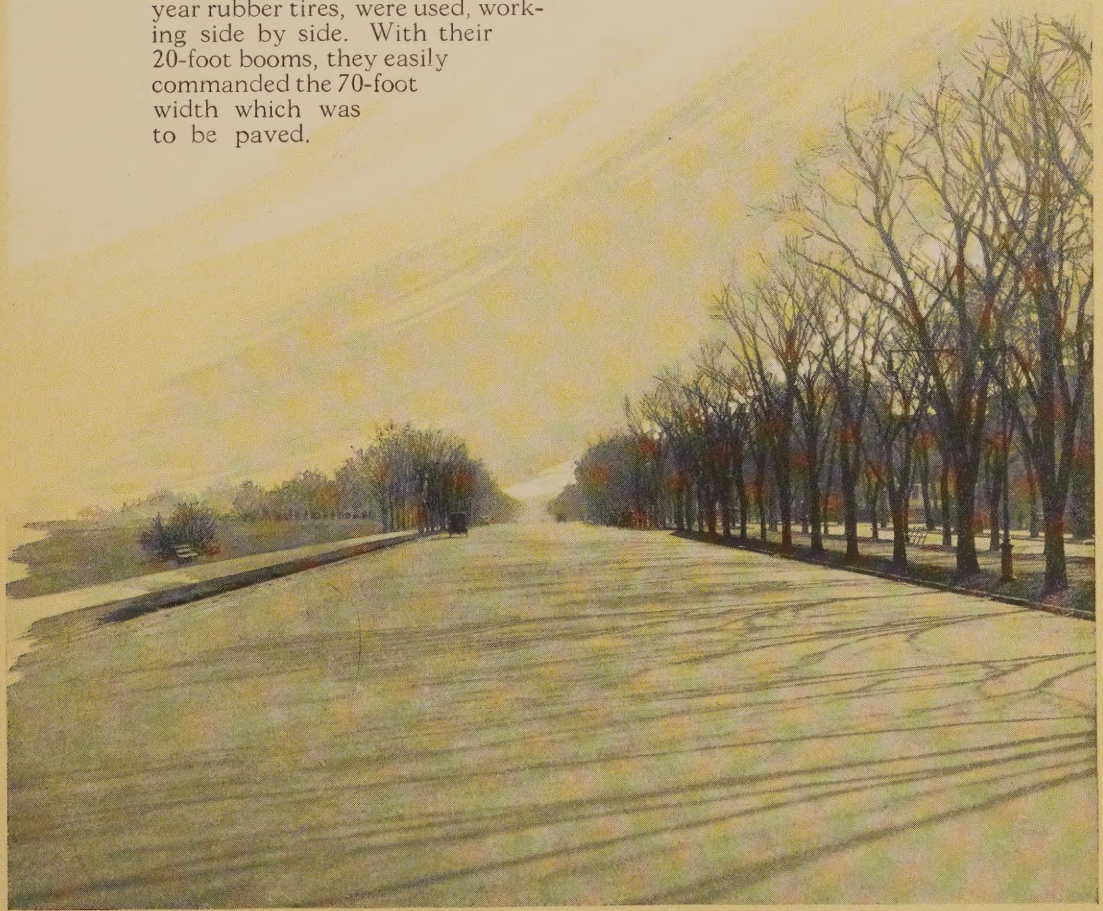
Coney Island is probably the country's most famous, popular amusement center. To accommodate the vast number of automobilists who travel back and forth each year from Brooklyn, a modern boulevard has been built. Completed in 1921 at a cost of $750,000 the Ocean Parkway improvement consists of 4½ miles of pavement 70 feet wide, —the largest continuous area of street paving ever placed under contract in the Borough of Brooklyn.

The boulevard runs from Park Circle near Prospect Park, to Avenue W. The work of paving was divided into three separate contracts.

The operations consisted in removing the old bituminous mat and the stone and gravel of the old roadway, followed by the laying of a six inch concrete base and then the surfacing with a 3-inch sheet of asphalt.

All contracts were completed in considerably less time than allowed due to the extensive use of machinery; on the largest one the work was finished in practically half the time the contract provided. This work was started on June 13, 1921, and completed August 8, 1921, while the contract allowance was seventy-five consecutive working days.

For the concreting, two Koehring Pavers, which were equipped with Goodyear rubber tires, were used, working side by side. With their 20-foot booms, they easily commanded the 70-foot width which was to be paved.



Kensington Trunk Sewer

A few years ago it became necessary to divert elsewhere the large amount of sewage and waste, from the great industrial section of South Chicago, which formerly had gone into Lake Michigan.

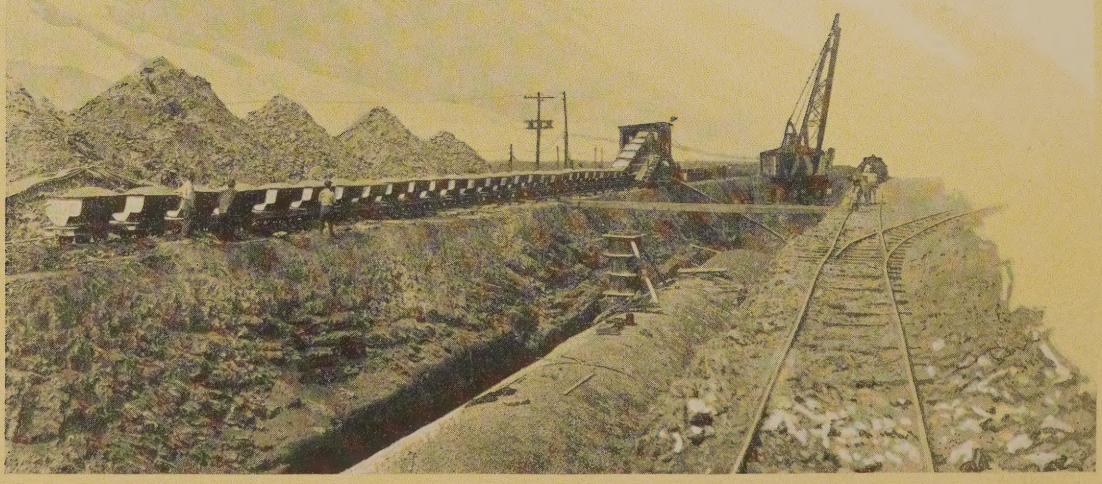
The Kensington Trunk Sewer accordingly was built at Pullman to conduct the sewage to the Calumet Sag Channel. This immense project is seven miles long, divided into seven separate sections, and required over four years to complete.

Construction of Section 5 was of particular interest due to the use of a specially designed movable platform on which the mixers were mounted and which were fed by industrial cars passing over the platform on an upper framework. The cars themselves were of unique interest being used originally by the French government in its attempt to build the Panama Canal.

The sewer is 17 feet 6 inches wide, 14 feet high and 4 feet thick on top. The excavation was 30 feet deep and 40 feet wide at the top.

One mixer, a Koehring 28S, mixed the 150,000 cubic yards of concrete which were used in the construction. In spite of the fact that a shortage of materials prevented full capacity operation, the contractors placed an average of seventy feet of completed sewer per day, or a daily average of more than two hundred fifty cubic yards of concrete.

It is interesting to note that a second Koehring 28S mixer, which was mounted in place alongside for use in case the first broke down at any time, never had a batch of concrete in its drum as long as it was on the work.



Elephant Butte Dam

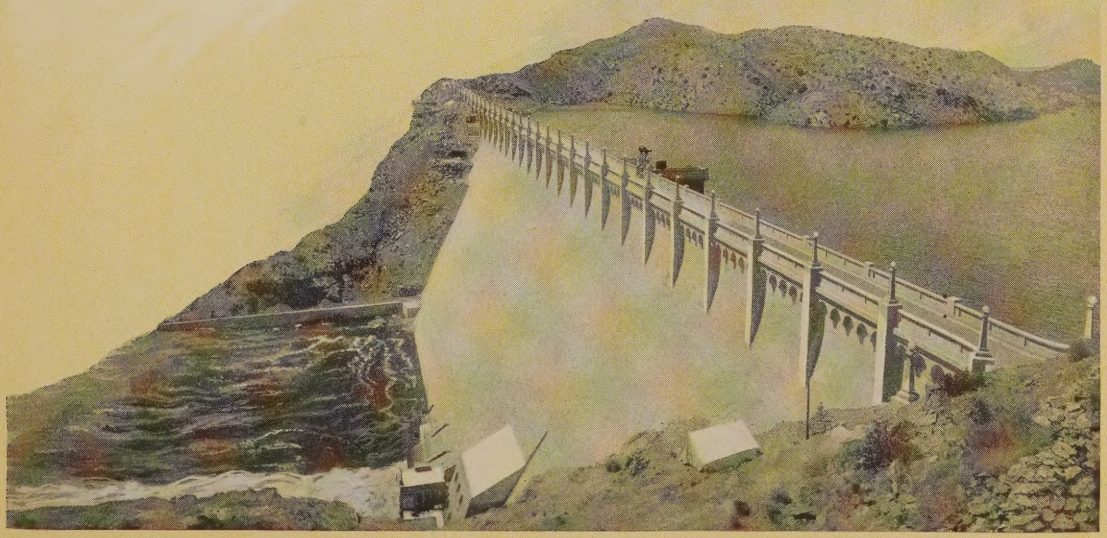
Started in 1904, when first investigations were undertaken, and completed in 1916, the Elephant Butte Dam, near Engle, New Mexico, has turned 180,000 acres of land in the Rio Grande Project, from barren wastes into fertile fields.

This stupendous feat of irrigation was achieved by the United States Reclamation Service, at a total cost of approximately $5,000,000. The dam is a gravity type structure 1,310 feet long across the top, and 306 feet high at its highest point. Water is controlled by the structure for irrigation purposes through four balanced valve gates each five feet in diameter.

The lake created, when the reservoir is filled to capacity, is the largest artificial lake for irrigation in the world. The reservoir has a capacity of 2,640,000 acre-feet; is 45 miles long, and embraces a shore line of 200 miles. Six penstock gates and openings were installed in the dam at the time of its construction, but no power for commercial use has yet been developed.

Over 600,000 cubic yards of masonry are contained in the structure, including about 10,000 of concrete. Here indeed is a marvelous engineering accomplishment, combining art, strength and utility—a gigantic structure surely "Built to Endure."

It is unnecessary to add that the two Koehring Mixers used in this work performed to the satisfaction of the engineers in charge and to the credit of the Koehring Company.



Parthenon Replica

Twenty-five years ago an exact replica of the Parthenon at Athens was constructed as an Art Gallery for the Tennessee Centennial Exposition, at Nashville, Tenn.

Except in materials used this building correctly reproduced for the first time in America the famous Grecian temple. The main building was of brick construction, stuccoed; the 46 columns were stuccoed over wooden lath and studs.

Now the building has been made permanent. The Park Commission expended approximately $300,000 reproducing in permanent material the textures and coloring of the original building.

The porticoes on the side consist of columns 34 feet high surmounted by a facade eight feet high. The end porticoes support above the facade a gable roof. The columns, each eight feet in diameter, at the base as well as at the facade above them, consist of reinforced concrete shells covered with a cast of mosaic concrete two inches in thickness.

Koehring Dandie Mixers, equipped with a light auxiliary hoist used to elevate the material to the top of the building, mixed all the concrete used in the work. The quality of the concrete was of particular importance in this instance and the uniformly well mixed material turned out was a source of gratification to the authorities in charge of the construction.

Drake Hotel—Chicago

Overlooking Lake Michigan, at Lake Shore Drive and Michigan Avenue, in Chicago, stands one of the finest examples of modern hotel architecture in the world.

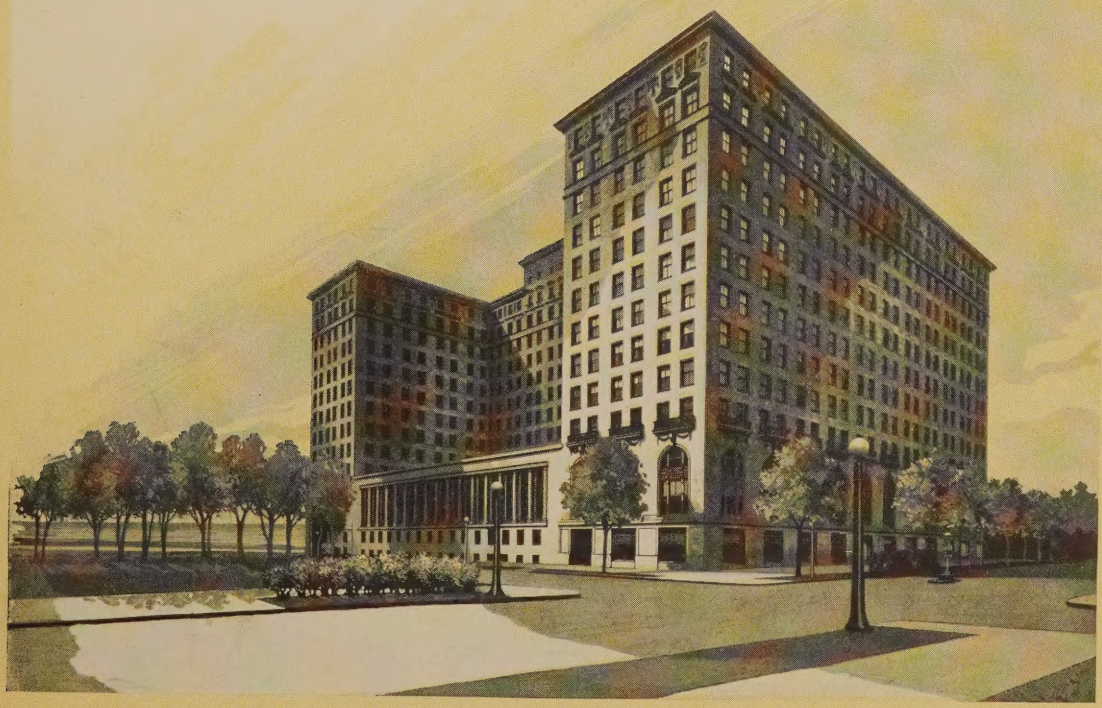
The Drake Hotel, opened on Thanksgiving Day, 1920, was erected at a cost of more than eight million dollars. Built in the shape of an "I," it is 600 feet long, 475 wide, and contains thirteen stories and basement. It has 800 guest rooms and in addition numerous halls, ball rooms and dining rooms, arranged to accommodate thousands in each at the same time without any confusion.

The entire exterior is faced with Bedford Stone; the foundations and walls are of reinforced concrete.

The Avenue of Palms located on the main floor is one of the striking features of the Drake. This is a vista 148 feet long and 58 feet wide banked on both sides with palms. Here will be found also, antique furniture brought from all corners of the world.

It is a marvelous place,—the very last word in hotel comfort. The seemingly interminable space of its public rooms; the high vaulted ceilings and dull-tone walls, and all-pervading air of restrained luxury and quiet refinement, achieve a dignity and impressiveness different from anything previously attempted.

The Koehring Company takes pride in the knowledge that Koehring Mixers exclusively furnished the concrete on this masterpiece of hotel designing.



University Stadium—Seattle

An accomplishment which will probably stand for years as a speed record in construction was achieved in the completion in six months of the athletic stadium at the University of Washington at Seattle.

On May 17, 1920, the site was a barren waste. Just six months later, on November 27, 1920, 28,000 spectators filled the concrete stands and watched the University of Washington's football warriors battle Dartmouth on the newly completed gridiron.

The stadium is horseshoe in shape, open at one end to give a view of Lake Washington, on the bank of which the stadium is located. The playing field is from 268 to 293 feet wide and 487 feet long; the out-to-out width of the top seat banks is 474 feet.

It was planned to approach as nearly as possible a balanced cut and fill, excavating by hydraulic giants the earth in the playing field area and sluicing it into place to form the mound for the seat banks on which the concrete seats were built. This involved the removal and transportation of 159,319 cubic yards of earth, with an added yardage of 67,994 brought in by truck to exactly balance the cut and fill.

Credit for their efficient work was due the two Koehring Mixers used for the concreting operations. These performed sturdily and steadily without fail, mixing the 3,000 yards of concrete required in the stadium.

Wilson—Pennsylvania

Building a complete town of nearly 3,000 inhabitants from the ground up is no small undertaking.

In September 1917 the new section of Wilson, Pennsylvania, was nothing more than an area of undeveloped land. Three years later, in September 1920, it was a town of 2,200 inhabitants with 493 houses, substantially built of brick or stucco with concrete foundation, 14 paved streets, three miles of alleys and overseven miles of sidewalks, all made of concrete.

The contract to build the section was let by the Carnegie Steel Company in August, 1917, and ground was broken the first week in September. A total amount of 250,000 cubic yards of earth was excavated in the streets, alleys, sewers, cellars and walks. Five cranes were used for this purpose.

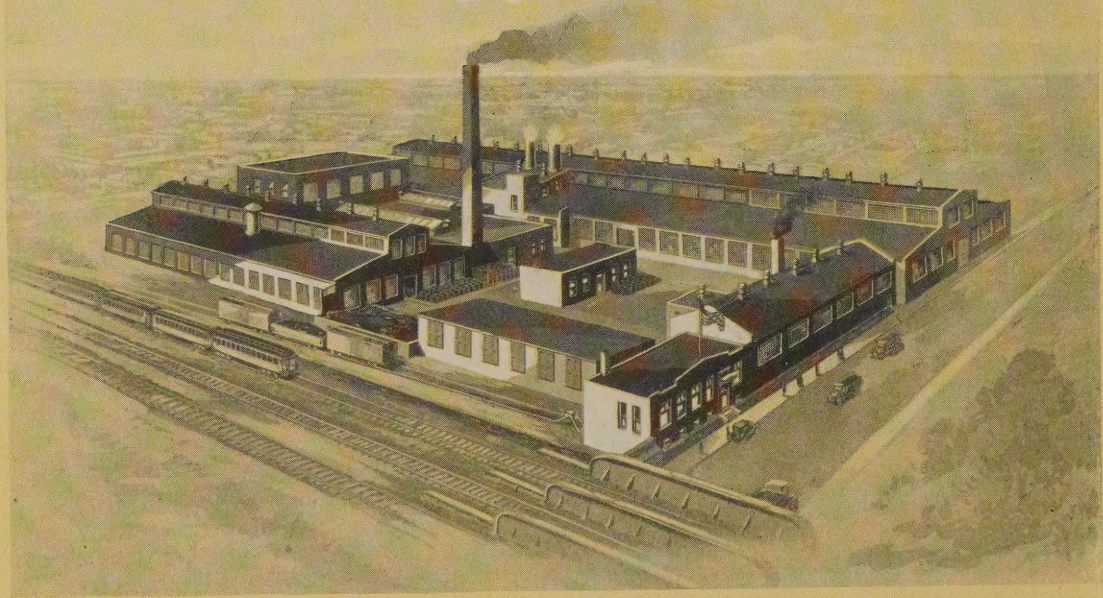
Koehring equipment was used exclusively for concreting work. The walks, steps, walls, foundations and disposal plant were made of concrete, mixed with Koehring Dandie Mixers, while the concrete used in streets and alleys was mixed with Koehring Pavers.

The houses range in size from three rooms to seven. All are equipped with coke furnaces and all with four rooms or more have bath rooms.

Besides this work the Carnegie Steel Company built 101 houses and 3,500 lineal feet of sidewalk in Clairton. These were included in the Wilson project, making a total of 594 houses erected.

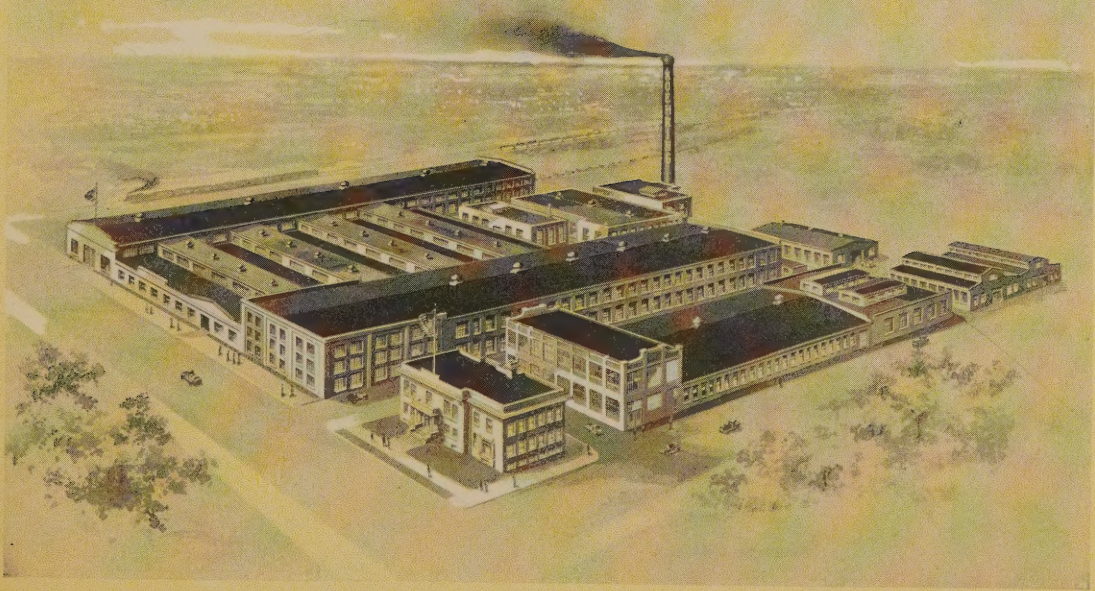
The Foundry

The Koehring Foundry, an integral part of the Koehring plant, assures the same high standard in the quality of the castings produced as is maintained throughout all other operations which enter into the manufacture of Koehring equipment.



Main Plant

Koehring equipment is built in a complete modern factory where science and machinery combine with willing, skillful, cheerful workers. Together they produce units that exemplify in design, material and construction—the Koehring policy of "Built to Endure."



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